New machine learning-based tool to help physicians determine best test for chest pain

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The choice between two non-invasive diagnostic tests is a common dilemma in patients who present with chest pain. Yale cardiologist Rohan Khera, MD, MS, and colleagues have developed ASSIST, a new digital decision-aiding tool.

By applying machine learning techniques to data from two large [clinical trials](#), this new tool identifies which imaging [test](#) to pursue in patients who may have [coronary artery disease](#) or CAD, a condition caused by plaque buildup in the arterial wall.

The new tool, described in a study published April 21 in the *European Heart Journal*, focuses on the long-term outcome for a given patient.

"There are strengths and limitations for each of these diagnostic tests," said Khera, an assistant professor of cardiology at Yale School of Medicine. Patients may have calcium in their [blood vessels](#) or a more advanced stage of the disease that can be missed. "If you are able to establish the diagnosis

correctly, you would be more likely to pursue optimal medical and procedural therapy, which may then influence the outcomes of patients."

Recent clinical trials have attempted to determine if one test is optimal. The PROMISE and SCOT-HEART clinical trials have suggested that anatomical imaging has similar outcomes to stress testing, but may improve long-term outcomes in certain patients.

"When patients present with chest pain you have two major testing strategies. Large clinical [trials](#) have been done without a conclusive answer, so we wanted to see if the trial data could be used to better understand whether a given patient would benefit from one testing strategy or the other," said Khera. Both strategies are currently used in clinical practice.

To create ASSIST, Khera and his team obtained data from 9,572 patients who were enrolled in the PROMISE trial through the National Heart, Lung and Blood Institute and created a novel strategy that embedded local data experiments within the larger clinical trial.

"A unique aspect of our approach is that we leverage both arms of a clinical trial, overcoming the limitation of real-world data, where decisions made by clinicians can introduce bias into algorithms," said Khera

The tool also proved effective in a distinct population of patients in the SCOT-HEART trial. Among 2,135 patients who underwent functional-first or anatomical-first testing, the authors observed a two-fold lower risk of adverse cardiac events when there was agreement between the test performed and the one recommended by ASSIST. Khera said he hopes this tool will provide further

insight to clinicians while they make the choice between anatomical or functional testing in chest pain evaluation.

Functional testing, commonly known as a stress test, examines patients for CAD by detecting reduced blood flow to the heart. The second option, anatomical testing, or coronary computed tomography angiography (CCTA), identifies blockages in the blood vessels. Using machine learning algorithms ASSIST provides a recommendation for each patient.

"While we used advanced methods to derive ASSIST, its application is practical for the clinical setting. It relies on routinely captured patient characteristics and can be used by clinicians with a simple online calculator or can be incorporated in the electronic health record," said Evangelos Oikonomou, MD, DPhil, a resident physician in Internal Medicine at Yale and the study's first author.

More information: Evangelos K Oikonomou et al. A phenomapping-derived tool to personalize the selection of anatomical vs. functional testing in evaluating chest pain (ASSIST), *European Heart Journal* (2021). DOI: 10.1093/eurheartj/ehab223

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